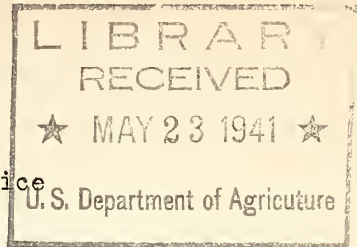


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EFFECTS OF GROUND PREPARATION  
ON SURVIVAL AND GROWTH OF PLANTED PINE AND BLACK LOCUST

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Ground preparation prior to planting has been thought to offer possibility of greater success in reforesting old fields in the Central States. The compaction of soils or the formation of a sod or a heavy herbaceous cover on old fields following their withdrawal from agricultural use seriously interferes with survival and growth of planted trees. Plowing or furrowing eliminates these conditions, thus bringing about better soil aeration and soil moisture conservation.

In 1935 a study was set up at the southern Illinois branch of the Central States Forest Experiment Station, on land recently acquired by the Government, to test the effect of plowing and furrowing in abandoned old fields on the establishment of subsequently planted pitch pine (Pinus rigida), shortleaf pine (P. echinata), and black locust (Robinia pseudoacacia). The sites selected had been abandoned for several years, and a cover of grass and herbs had become established. The soil (tentatively identified as Ava silt loam) was a friable, brownish-yellow silt loam, with a slightly compact silty clay loam subsoil, underlain by a blue St. Louis limestone. An area of 0.8 acre was selected for shortleaf pine, one of 1.5 acres for pitch pine, and two of 0.9 and 2.2 acres (designated as field plots 3 and 5, respectively) for black locust. Each area was divided roughly into three strips of which one was plowed and one furrowed, both to a depth of 6 inches, and one was left untreated as a check. These areas were planted in March 1935, with 1-1 pitch pine, 1-0 shortleaf pine, and 1-0 black locust.

In 1937 a series of plantings was made in Hocking County, Ohio, designed primarily for study of relative survival and growth of 1-0 and 1-1 stock of pitch pine and of shortleaf pine. Two comparable old-field sites were used, the soil of which was a Muskingum stony loam. On each site two plots were laid out, of which one was plowed as a preliminary to planting and the other was given no preparation. The four classes of stock were assigned randomly to 4-row sampling units on each plot. Although intended primarily for comparison of results with trees of different species and ages, the experiment was so designed that variation in survival and growth resulting from plowing could be segregated and evaluated.

In the southern Illinois planting survival counts were made and the heights of about 200 trees were measured on each strip of pitch pine and shortleaf pine in the fall of 1939, after five growing seasons. In the black locust plantings, height measurements were taken at that time on all trees. Summaries of the data are presented in table 1. Mortality of black locust was abnormal because of heavy rabbit injury. Mean heights of black locust are presented in table 2.

Table 1.--Five-year mean mortality and height increment of pitch and shortleaf pines on southern Illinois areas

Species and ground preparation	Mortality	Height increment	Standard error of mean of height increment
	<u>Percent</u>	<u>Feet</u>	<u>Feet</u>
Pitch pine			
Plowing	3.9	8.31	0.07
Furrowing	7.4	8.21	.08
None	4.1	8.07	.08
Shortleaf pine			
Plowing	12.6	8.52	.10
Furrowing	14.3	7.69	.15
None	18.3	7.90	.12

Table 2.--Five-year mean height increment of black locust on southern Illinois areas

Plot and ground preparation	Height increment	Standard error of mean
	<u>Feet</u>	<u>Feet</u>
Plot 3		
Plowing	9.69	0.21
Furrowing	9.09	.18
None	8.38	.24
Plot 5		
Plowing	14.70	.24
Furrowing	10.60	.24
None	11.63	.28

In the Hocking County plantings, heights of all trees were measured and yearly increments calculated at the end of each growing season. Mean height-increment values for the first 3 years are typical, and are presented for four classes of stock on plowed and unprepared ground in table 3. Mortality differences were slight.

Table 3.--Three-year height increment of two classes of pitch and shortleaf pine stock on areas in Hocking County, Ohio

Ground preparation	Height increment, by species and class of stock			
	Pitch pine		Shortleaf pine	
	1-0	2-0	1-0	2-0
	<u>Feet</u>	<u>Feet</u>	<u>Feet</u>	<u>Feet</u>
Plowing	2.29	2.66	2.64	2.51
None	1.72	2.14	2.32	1.92



Five-year height growth of the pines planted in southern Illinois in 1935, which differed very little by species, was consistently better on plowed than on unprepared ground. For pitch pine, the advantage in growth associated with plowing amounted to 0.24 foot, a statistically significant difference. Growth on furrowed strips was superior to that on untreated and inferior to that on plowed strips, but the differences were not significant. Five-year height growth of shortleaf pine was greater on plowed ground than on furrowed and untreated ground by the highly significant mean differences of 0.83 and 0.62 foot, respectively. Mortality figures were somewhat inconsistent, but trees of both species survived best on plowed ground. The shortleaf pine mortality of 18.3 percent on the untreated strip was noticeably higher than that on either of the treated strips. Furrowing led to greater mortality of pitch pine. This effect, and also the deficiency in height growth of shortleaf pine on furrowed ground, arose from silting in the furrows after heavy rains. It is quite possible that damage from silting in furrows could be largely eliminated by reducing furrow depth. Differences among plantings of the same year were more clear-cut for black locust than for pine. Five-year height increment of black locust was greater on the two plowed strips than on the corresponding untreated strips by 1.31 and 3.12 feet, respectively. On plot 3 growth was greater on the furrowed strip than on the check strip, but on plot 5, apparently because of some silting injury, it was less on the furrowed strip than on the check strip.

Trees in the Hocking County pine planting, having passed through but three growing seasons, did not show so much variation in height growth as did those planted in southern Illinois. The differences in the two experiments were consistent in that growth of trees on plowed land invariably exceeded that on untreated land, and were highly significant. The greatest difference, 0.59 foot, appeared in growth of shortleaf pine 2-0 stock; the least, 0.32 foot, in growth of shortleaf pine 1-0 stock.

On the basis of these experiments it seems too early to recommend ground preparation as a means for increasing survival and height growth of the species studied in general reforestation programs. While on abandoned old fields with certain soil types it has been found that the advantage occasioned by plowing persists to the end of the fifth growing season, height differences are generally small and the slight dominance of trees on plowed ground may disappear as the trees mature. Differences in mortality are insignificant and not commensurate with the cost of ground preparation. The results indicate, however, that plowing does have a beneficial effect, especially on black locust, and on more severe sites may mean the difference between success and failure of a plantation. Ground preparation, though seldom feasible in connection with ordinary field planting, is probably justified in the case of certain critical areas on which the establishment of a forest cover is imperative but on which--by reason of soil or vegetation difficulties--tree seedlings will not survive and grow without it. At any rate, it is safe to say that further investigation on more severe sites and with other species is warranted.